

Chapter 15 The Excretory/Urinary System

OVERVIEW

The purpose of this chapter is to teach the anatomy and physiology of the excretory/urinary system and to present select concepts associated with pathophysiology or disease issues of the integumentary system. The chapter covers all of the organs of the excretory system and the wastes they remove before concentrating on the kidneys and the formation and elimination of urine.

This chapter is representative as to how knowledge builds throughout the chapters of this text. Students will use prior knowledge from chapters 1-7, 9-11, and 13 in their study of this system. A group activity listed under Individual Outcome 15.15 uses a scenario similar to those used to explain endocrine functions in Chapter 9. Here the scenario is described in spot check questions 6 and 7 to assess the understanding of urine production regulation.

Chapter figures can be found in the Online Learning Center (OLC). Discussion points, group activities, and quizzes listed in the summary table below are explained under their individual outcomes following the table. Answer keys to the text chapter review questions, workbook concept maps, and workbook review questions are located at the end of the chapter.

A review guide is also available on the OLC. This guide lists all of the learning outcomes for the chapter and gives space for students to take notes and make sketches. This can be an important tool to encourage students to pay attention to what they are learning and to use to either take initial notes or to organize their existing notes before exams.

Learning Outcome	CAAHEP Competencies	ABHES Competencies
15.1 Use medical terminology related to the excretory system.	I.C.1. Describe structural organization of the human body	3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e., root, prefix, suffix, combinations, spelling and definitions
15.2 Define excretion and identify the organs that excrete waste.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.3 List the body's major nitrogenous wastes and their sources.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.4 List the functions of the kidneys in addition to urine production.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their

		common diseases, symptoms and etiologies.
15.5 Describe the external and internal anatomy of the kidneys.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.6 Describe the anatomy of a nephron.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.7 Trace the components of urine through a nephron.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.8 Trace the flow of blood through a nephron.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.9 Describe filtration, reabsorption, and secretion in the kidneys with regard to the products moving in each process, the direction of movement, and the method of movement.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.10 Describe the fluid compartments of the body and how water moves between them.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.11 Explain how urine volume and concentration are regulated.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.12 Explain how diuretics, such as medications, caffeine, and alcohol, affect urine production.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.13 Describe the anatomy of the ureters, urinary bladder, and male and female urethras.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.14 Describe the micturition reflex and explain how the nervous system and urinary sphincters control the voiding of urine.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.15 Summarize the functions of the excretory system.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

15.16 Summarize the effects of aging on the excretory system.	I.C.10. Compare body structure and function of the human body across the life span	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.17 Describe common diagnostic tests used for excretory system disorders.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
15.18 Describe excretory system disorders and relate abnormal function to pathology.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

SUMMARY TABLE 15

LEARNING OUTCOME	LECTURE OUTLINE	ACTIVITIES – TALKING POINTS	ASSESSMENTS
15.1 Use medical terminology related to the excretory system.			<i>WkBk Chapter Review Questions:</i> <ul style="list-style-type: none"> Word Deconstruction: 1-5
15.2 Define <i>excretion</i> and identify the organs that excrete waste.	I. Overview Chapter Figure: 15.2 (Organs of the excretory system)	Talking Point: Cells <i>secrete</i> products that will be used elsewhere. Cells <i>excrete</i> wastes created through chemical processes within the cell. It is important to understand the difference between these two terms.	<i>WkBk Chapter Review Questions:</i> <ul style="list-style-type: none"> Completion:1
15.3 List the body's major nitrogenous wastes and their sources.	A. Ammonia B. Urea C. Uric acid D. Creatinine	Talking Point: A review of organic molecules from Chapter 2 may be helpful to show that all proteins and nucleic acids contain nitrogen. Talking Point: Be sure students do not confuse	<i>WkBk Chapter Review Questions:</i> <ul style="list-style-type: none"> Completion: 2-5

	Chapter Figure: 15.3 (Nitrogenous waste)	creatine (muscle chemical) with creatinine (urinary chemical).	
15.4 List the functions of the kidneys in addition to urine production.	E. Excretion of waste F. Regulation of blood volume G. Delivery of urine H. Control of urine production	Talking Point: This outcome reviews kidney functions mentioned in Chapters 3, 4, 9, and 10. Be sure to review how the kidneys are involved in RBC formation, regulation of pH, and regulation of ions, etc.	WkBk Chapter Review Questions: <ul style="list-style-type: none"> MS: 1 Critical Thinking: 2
15.5 Describe the external and internal anatomy of the kidneys.	II. Anatomy of the kidney Chapter Figures: 15.4 (Retroperitoneal position of the kidney) 15.5 (Gross anatomy of the kidney)	WkBk Coloring Book: <ul style="list-style-type: none"> Kidney Figure 15.2 (Anatomy of the kidneys)	Spot Check: 1 WkBk Chapter Review Questions: <ul style="list-style-type: none"> MS: 2
15.6 Describe the anatomy of a nephron.	A. Anatomy of a nephron <ol style="list-style-type: none"> 1. Renal corpuscle <ol style="list-style-type: none"> a. glomerular capsule b. glomerular capillaries 2. Renal tubule <ol style="list-style-type: none"> a. PCT b. nephron loop c. DCT Chapter Figures:	Talking Point: It helps to cover the anatomy of a nephron in a step by step progression by covering the stretched out glomerular capsule and tubules (Figure 15.6b, before the properly positioned glomerular capsule and tubules (Figure 15.7a), and then the properly placed glomerular capsule and tubules with blood vessels in Figure 15.8. WkBk Coloring Book: <ul style="list-style-type: none"> Nephron Figure 15.3 (Anatomy of a nephron)	Spot Check: 2 WkBk Chapter Review Questions: <ul style="list-style-type: none"> Matching: 8, 10

	15.6 (Microscopic anatomy of a nephron) 15.7 (Nephron)		
15.7 Trace the components of urine through a nephron.	B. Flow of urine components through a nephron Chapter Figure: 15.6 (Microscopic anatomy of a nephron) 15.7 (Nephron)		WkBk Chapter Review Questions: <ul style="list-style-type: none">MS: 3
15.8 Trace the flow of blood through a nephron.	C. Blood flow to a nephron Chapter Figure: 15.8 (The renal nephron and the associated blood vessels)	Talking Point: Have the students make a chart listing the sequence of blood flow to and from the kidney. Have a chart showing the sequence of the flow of waste to the kidney and through the nephron. Have a chart showing the sequence of the flow of water to the nephron and then reabsorbed into the vasa recta. Have a chart showing the sequence of the flow of blood if blood were to enter into the urine (blood in the urine).	Quiz: 1 (Covers LOs 15.6-15.8. See Individual Outcome 15.8.) Figure IMQ15.1 Spot Check: 3 WkBk Chapter Review Questions: <ul style="list-style-type: none">MS: 4Matching: 9
15.9 Describe filtration, reabsorption,	III. Physiology of urine	WkBk lab Exercises and Activities:	Quiz: 2

and secretion in the kidneys with regard to the products moving in each process, the direction of movement, and the method of movement.	<p>production</p> <p>A. Filtration</p> <p>B. Reabsorption</p> <p>C. Secretion</p> <ol style="list-style-type: none"> 1. Respiratory acidosis 2. Metabolic acidosis 3. Respiratory alkalosis 4. Metabolic alkalosis <p>D. Water conservation</p> <p>Chapter Figures:</p> <p>15.9 (Homeostasis of blood pH)</p> <p>15.10 (The process of urine production)</p>	<ul style="list-style-type: none"> • Urinalysis <p>Figures:</p> <p>15.5 (Urine sample for urinalysis)</p> <p>15.6 (A hydrometer used to test the specific gravity of urine)</p> <p>15.7 (Glucose test strips used for urinalysis)</p> <p>15.8 (Ketone test strips used for urinalysis)</p> <p>15.9 (Urine sediments)</p> <p>15.10 (Crystalline urine sediments)</p> <p>WkBk Concept Maps:</p> <ul style="list-style-type: none"> • Filtration <p>Figure 15.11 (Filtration concept map)</p> <ul style="list-style-type: none"> • Reabsorption <p>Figure 15.12 (Reabsorption concept map)</p> <ul style="list-style-type: none"> • Secretion <p>Figure 15.13 (Secretion concept map)</p>	<p>(Covers LOs 15.6-15.9. See Individual Outcome 15.9)</p> <p>Figure IMQ15.2</p> <p>Spot Check: 4</p> <p>WkBk Chapter Review Questions:</p> <ul style="list-style-type: none"> • Matching: 1-7
15.10 Describe the fluid compartments of the body and how water moves between them.	<p>E. Water in the body</p> <p>Chapter Figures:</p> <p>15.11 (The movement of water between major fluid compartments)</p> <p>15.12 (Daily water intake and output)</p>		<p>WkBk Chapter Review Questions:</p> <ul style="list-style-type: none"> • MS: 5

<p>15.11 Explain how urine volume and concentration are regulated.</p>	<p>F. Regulation of urine volume and concentration</p> <p>1. Hormonal mechanisms of control</p> <p>a. ADH</p> <p>b. Aldosterone</p> <p>c. Atrial natriuretic hormone</p> <p>2. Autonomic mechanisms of control</p> <p>Chapter Figures:</p> <p>15.13 (Action of antidiuretic hormone)</p> <p>15.14 (Action of aldosterone)</p> <p>15.15 (The renin-angiotensin-aldosterone connection)</p> <p>15.16 (Action of atrial natriuretic hormone)</p>	<p>Discussion Point: Hormones (See under Individual Outcome 15.11)</p> <p>WkBk lab Exercises and Activities:</p> <ul style="list-style-type: none"> • Urinalysis <p>Figures:</p> <p>15.5 (Urine sample for urinalysis)</p> <p>15.6 (A hydrometer used to test the specific gravity of urine)</p> <p>15.7 (Glucose test strips used for urinalysis)</p> <p>15.8 (Ketone test strips used for urinalysis)</p> <p>15.9 (Urine sediments)</p> <p>15.10 (Crystalline urine sediments)</p> <p>Talking Point: Sometimes ANH is called ANP (atrial natriuretic peptide).</p> <p>Talking Point: Discuss how kidney stones can form.</p> <p>WkBk Concept Maps:</p> <ul style="list-style-type: none"> • Hormonal control <p>Figure:</p> <p>15.14 (Hormonal control concept map)</p>	<p>Spot Check: 5-7</p> <p>WkBk Chapter Review Questions:</p> <ul style="list-style-type: none"> • MS: 6 • Critical Thinking: 1
<p>15.12 Explain how diuretics, such as medications, caffeine, and alcohol,</p>	<p>3. Diuretics</p> <p>i. Alcohol</p>		<p>WkBk Chapter Review Questions:</p> <ul style="list-style-type: none"> • MS: 7

affect urine production.	ii. Caffeine iii. Diuretic drugs		
15.13 Describe the anatomy of the ureters, urinary bladder, and male and female urethras.	IV. Anatomy of ureters, urinary bladder, and male and female urethras A. Ureters B. Urinary bladder C. Urethra Chapter Figures: 15.17 (The urinary system) 15.18 (The calyces and renal pelvis) 15.19 (The urinary bladder and urethra)	WkBk Coloring Book: <ul style="list-style-type: none">Urinary system Figure 15.1 (Anatomy of the urinary system) <ul style="list-style-type: none">Ureters, urinary bladder, and male urethra Figure 15.4 (The ureters, urinary bladder, and urethra) Talking Point: This would be a good time to show images of patients who have two ureters on the left and one on the right (for example).	WkBk Chapter Review Questions: <ul style="list-style-type: none">MS: 8
15.14 Describe the micturition reflex and explain how the nervous system and urinary sphincters control the voiding of urine.	V. Physiology of the passing of urine Chapter Figure: 15.20 (Neural control of micturition)	WkBk Concept Maps: <ul style="list-style-type: none">Micturition Figure: 15.15 (Micturition concept map)	Quiz: 3 (Covers LOs 15.13 and 15.14. See Individual Outcome 15.14.) Figure IMQ15.3 WkBk Chapter Review Questions: <ul style="list-style-type: none">MS: 9
15.15 Summarize the functions of the excretory system.	VI. Functions of the excretory system	Group Activity: Charting hormones. (See Individual Outcome 15.15.)	WkBk Chapter Review Questions: <ul style="list-style-type: none">MS: 1

	<p>A. Removal of metabolic wastes</p> <p>B. Maintenance of the body's fluid and electrolyte balance</p> <p>C. Maintenance of the body's acid-base balance</p> <p>D. Regulation of blood pressure</p> <p>Chapter Figure: 15.21 (Nikki and Chris at the theater)</p>	<p>WkBk lab Exercises and Activities:</p> <ul style="list-style-type: none"> • Urinalysis <p>Figures:</p> <p>15.5 (Urine sample for urinalysis)</p> <p>15.6 (A hydrometer used to test the specific gravity of urine)</p> <p>15.7 (Glucose test strips used for urinalysis)</p> <p>15.8 (Ketone test strips used for urinalysis)</p> <p>15.9 (Urine sediments)</p> <p>15.10 (Crystalline urine sediments)</p>	<ul style="list-style-type: none"> • Critical Thinking: 2
15.16 Summarize the effects of aging on the excretory system.	VII. Effects of aging on the excretory system		<p>WkBk Chapter Review Questions:</p> <ul style="list-style-type: none"> • MS: 10
15.17 Describe common diagnostic tests used for excretory system disorders.	<p>VIII. Diagnostic tests for excretory system disorders</p> <p>A. Biopsy</p> <p>B. Blood tests</p> <p>C. CT</p> <p>D. Cystoscopy</p> <p>E. IVP</p> <p>F. Ultrasound</p> <p>G. Urinalysis</p>	<p>WkBk lab Exercises and Activities:</p> <ul style="list-style-type: none"> • Urinalysis <p>Figures:</p> <p>15.5 (Urine sample for urinalysis)</p> <p>15.6 (A hydrometer used to test the specific gravity of urine)</p> <p>15.7 (Glucose test strips used for urinalysis)</p> <p>15.8 (Ketone test strips used for urinalysis)</p> <p>15.9 (Urine sediments)</p> <p>15.10 (Crystalline urine sediments)</p>	<p>Spot Check: 9</p> <p>WkBk Case Study: 2</p>

	Table: 15.1 (Common diagnostic tests for excretory system disorders)		
15.18 Describe excretory system disorders and relate abnormal function to pathology.	IX. Disorders of the excretory system A. Urethritis B. Cystitis C. Hydronephrosis D. Polycystic kidney disease E. Kidney stones F. Glomerulonephritis G. Renal failure Figures: 15.22 (Hydronephrosis) 15.23 (Polycystic kidney) 15.24 (Kidney stones) X. Cancers of the excretory system A. Kidney cancer B. Bladder cancer Table: 15.2 (Summary of diseases and disorders of the excretory system)	Group Activity: Kidney Failure. (See Individual Outcome 15.17.)	Spot Check: 9 WkBk Chapter Review Questions: <ul style="list-style-type: none"> • Critical Thinking: 3 WkBk Case Study: 1, 3, 4

INDIVIDUAL OUTCOMES

OUTCOME 15.5

Spot Check 1: Once the abdominal organs have been pushed aside, what specific membrane must be pierced to access the kidney?

Answer: The parietal peritoneum.

OUTCOME 15.6

Spot Check 2: List the parts of a nephron in order.

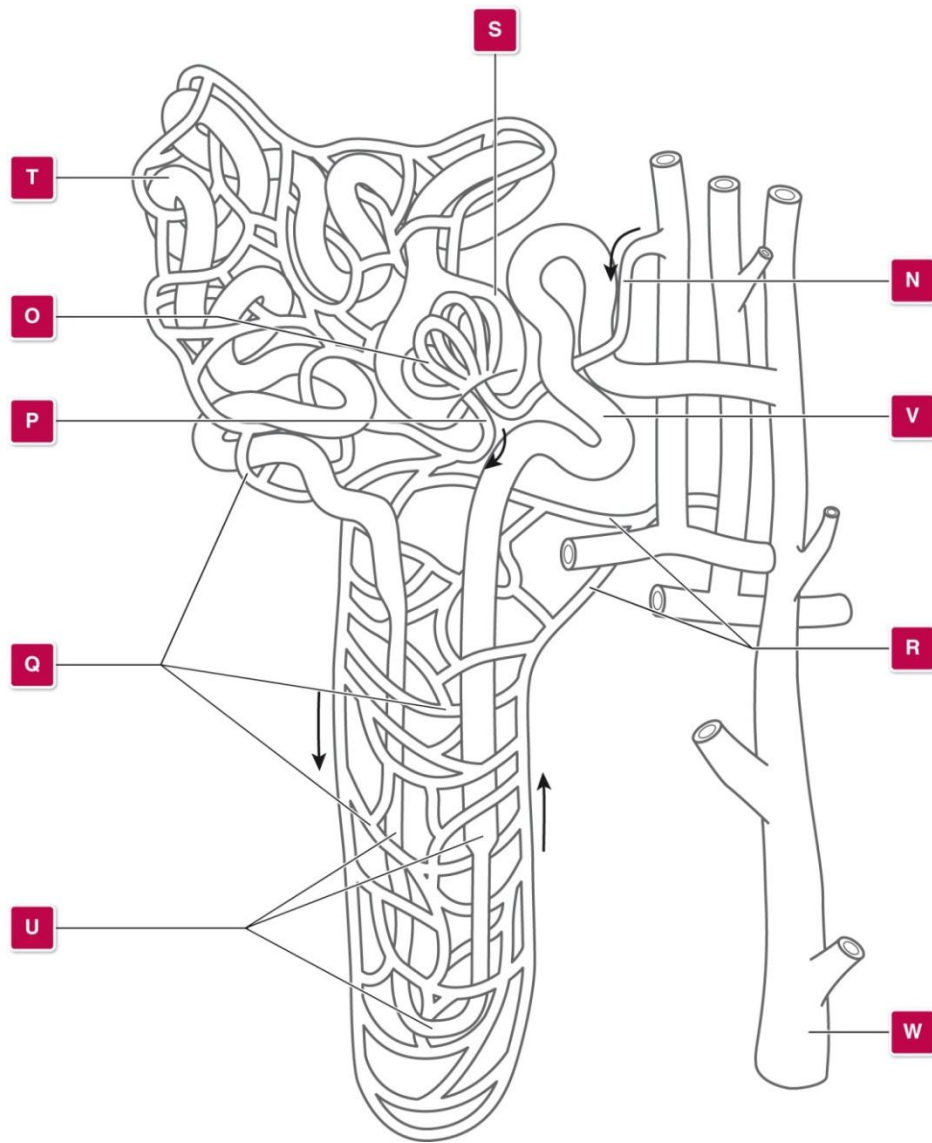
Answer: The renal corpuscle (glomerulus and glomerular capsule), the proximal convoluted tubule, the nephron loop, and the distal convoluted tubule, which leads to a collecting duct.

OUTCOME 15.8

Spot Check 3: Where does blood go after leaving the efferent arteriole?

Answer: The peritubular capillaries.

Quiz: 1



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1. Identify S.
2. Identify U.
3. Identify R.
4. Identify V.
5. Identify P.
6. Identify O.
7. What travels within O?
8. Identify T.
9. What travels within T?
10. Identify Q.

Glomerular capsule (Bowman's capsule)

Nephron loop

Venules

Distal convoluted tubule

Efferent arteriole

Glomerulus

Blood

Proximal convoluted tubule

Components of urine

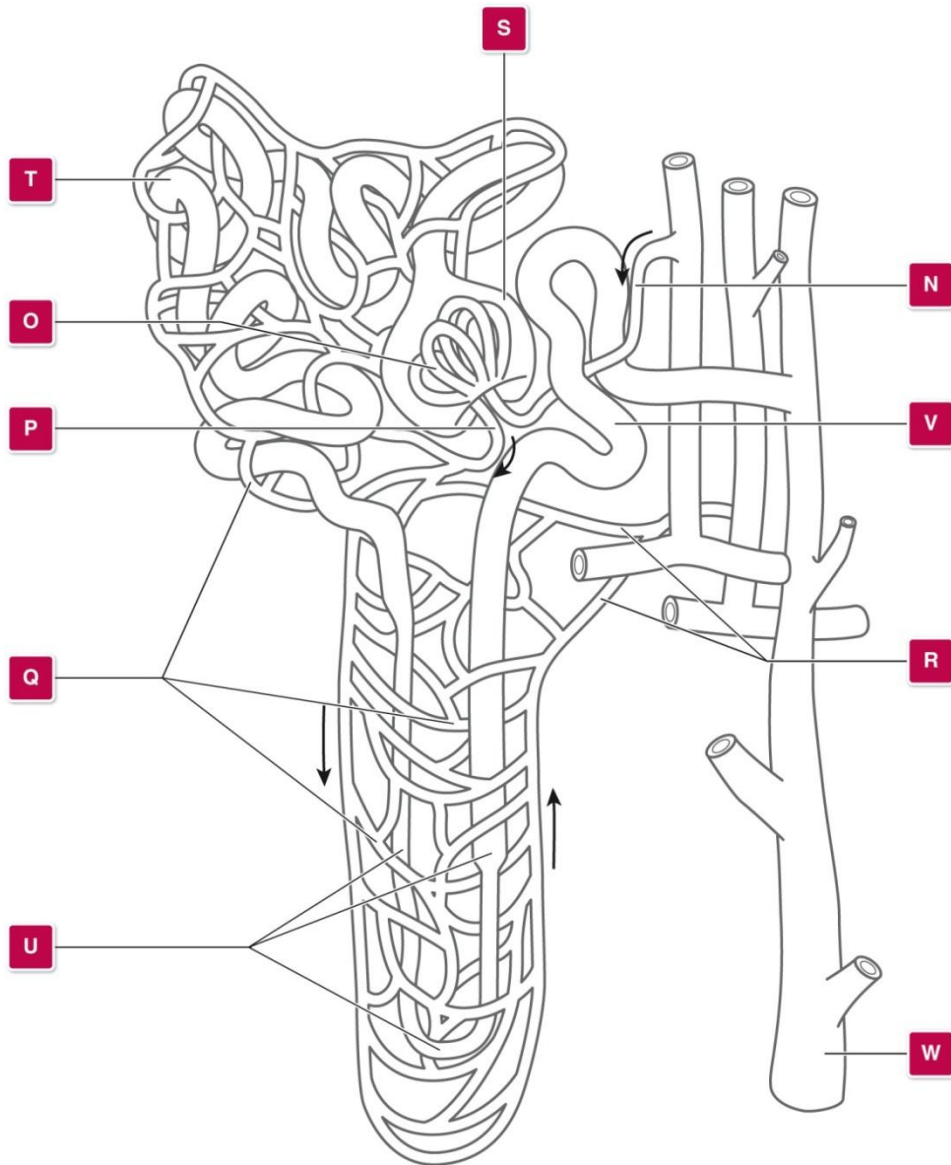
Peritubular capillaries

OUTCOME 15.9

Spot Check 4: Could reabsorption happen in the renal corpuscle before filtration? Explain.

Answer: No. High blood pressure is pushing materials out of the capillaries in the renal corpuscle during filtration. This must happen before some of these materials are reabsorbed back into the capillaries.

Quiz: 2



- | | |
|--|--|
| 1. Identify S. | <i>Glomerular capsule</i> |
| 2. Identify O. | <i>Glomerulus</i> |
| 3. What process of urine production takes place between S and O? | <i>Filtration</i> |
| 4. What direction are materials moving in this process (use terms for structures)? | <i>Glomerulus to the glomerular capsule</i> |
| 5. What materials are moving? | <i>Water, amino acids, glucose, some nitrogenous wastes, mineral salts</i> |
| 6. Identify T. | <i>Proximal convoluted tubule</i> |
| 7. Identify Q. | <i>Peritubular capillaries</i> |
| 8. What process of urine production begins between T and Q? | <i>Reabsorption</i> |
| 9. What direction are materials moving in this process (use terms for structures)? | <i>From the proximal convoluted tubule to the peritubular capillaries</i> |
| 10. What materials are moving? | <i>100% of amino acids, 100% of glucose, 99% water, and some mineral salts</i> |

OUTCOME 15.11

Spot Check 5: Cameron is in a car accident and has internal bleeding. As a result, his blood pressure suddenly falls. What has to happen for the kidneys to reabsorb more sodium, and therefore more water, in an attempt to maintain blood pressure?

Answer: The juxtaglomerular apparatus must first notice the fall in blood pressure. It then secretes renin, which changes a protein from the liver to angiotensin I. ACE converts angiotensin I to angiotensin II. Angiotensin II travels to the adrenal cortex telling it to secrete aldosterone. Once aldosterone is received by the kidneys, more sodium is actively transported from the tubule to the peritubular capillaries, and water follows sodium through osmosis.

Spot Check 6: What hormone is likely to be released to regulate urine production while Chris is eating all the salty popcorn but not drinking fluids? Explain.

Answer: ADH will conserve water without conserving sodium.

Spot Check 7: What hormone is likely to be released to regulate urine production if Chris drinks large amounts of fluids after the movie? Explain.

Answer: ANH will be released by cells in the right atrium in response the increased blood pressure as a direct result of the increased blood volume.

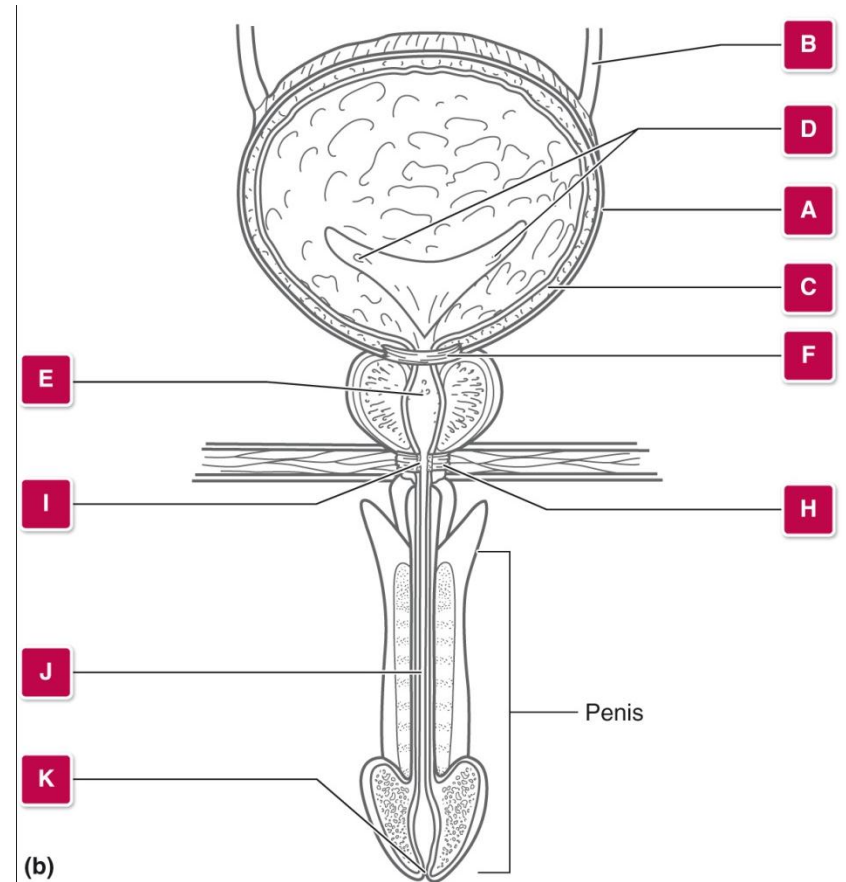
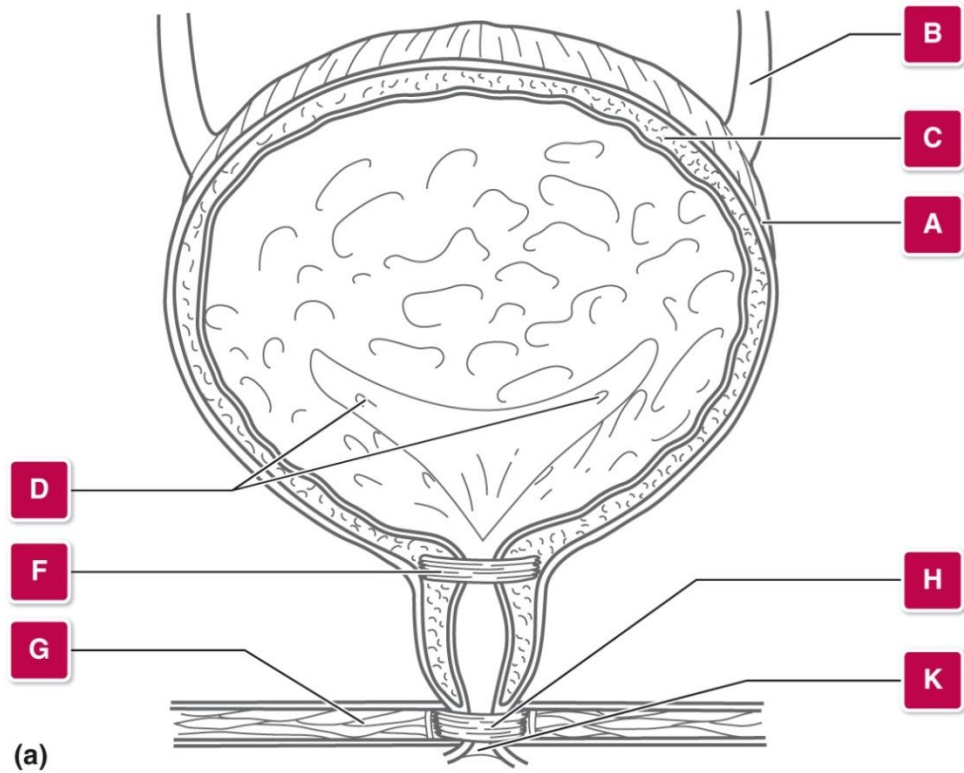
Discussion Point: Hormones

Figures 15.13, 15.14, and 15.16 show the action of ADH, aldosterone, and ANH respectively. Why is there only one negative feedback arrow in Figures 15.13 and 15.14, but two arrows in 15.16?

Negative feedback mechanisms reverse a movement away from homeostasis. The arrows therefore show movement towards homeostasis, not just the halt to the movement away. Reducing urine volume with ADH does not increase blood pressure. It prevents it from dropping at a greater rate. Maintaining blood volume and sodium concentration, in the case of aldosterone, does not return blood pressure and blood sodium levels to normal.

OUTCOME 15.14

Quiz: 3



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1. Identify muscle C.
2. What type of muscle tissue makes up muscle C?
3. Identify muscle H.
4. What type of muscle tissue makes up muscle H?
5. Where are the receptors that initiate the micturition reflex located?
6. What is the integration center for the micturition reflex?
7. What is (are) the effector(s) for the micturition reflex?
8. What controls H?
9. Identify B.
10. Identify K.

Detrusor muscle
Smooth muscle
External urethral sphincter
Skeletal muscle
Walls of the urinary bladder
Spinal cord
The detrusor muscle and internal urethral sphincter
The cerebrum
Ureter
Urethral orifice

OUTCOME 15.15

Group Activity: Charting hormones.

This activity is similar to the charting of hormones to answer scenario questions in Chapter 8. Divide the class into groups. Ask each group to chart the glands, hormones, target tissues, and functions that are relevant to Spot Check questions 6 and 7. Each group should be prepared to share its work with the class and use their charts to explain the answers to Spot Check questions 6 and 7.

OUTCOME 15.17

Spot Check 8: Explain what an intravenous pyelogram is and how it is used to specifically diagnose disorders of the excretory system.

Answer: This is an X-ray of the kidneys and the urinary tract. It uses contrast dye to help the physician see any abnormalities in the kidneys or any part of the urinary tract.

Case Study 2: How is the condition diagnosed?

Answer: This condition (hydronephrosis) can be determined by a CT, intravenous pyelography, ultrasound, blood tests and urine tests.

OUTCOME 15.18

Spot Check 9: Dialysis is usually performed at a dialysis center three times a week for three to five hours at a time. Why might it be more difficult to manage blood pressure for a patient on dialysis?

Answer: Fluid intake adds to blood volume. Increased blood volume means increased blood pressure. Fluid intake would have to be monitored closely as excess fluids would only be cleared from the system three times a week.

Case Study

1: What is hydronephrosis?

Answer: This is a build-up of urine in the kidney, which results from an obstructed flow of urine from the kidney.

3: Considering the fact that the physician discovered this condition during an ultrasound, before the baby was born, what is the likely cause of hydronephrosis in this infant?

Answer: Most likely there was a blockage or perhaps a “pinched” urinary tube thus hindering the flow of urine thereby creating an enlarged kidney.

4: Can the baby’s condition be treated? Please explain your answer.

Answer: This condition can be treated. The ultrasound will determine where the blockage is and surgery will be necessary to remove the blockage.

Group Activity: Kidney failure.

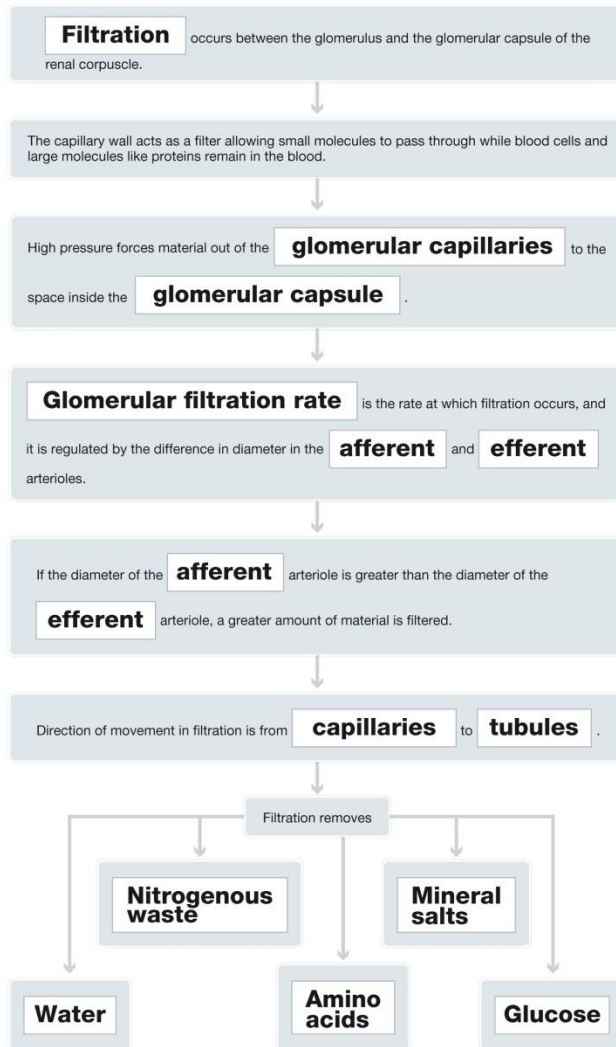
Develop a class list of questions concerning the cause, treatment, and prognosis for kidney failure, or select from the questions below.

- What causes kidneys to fail?
- What is the prevalence of kidney failure?
- What are the treatments for kidney failure?
- How does dialysis work? How often must it be done? What is the long term prognosis? What is the cost? What is the availability? Where can dialysis be performed locally?
- How is a kidney transplant accomplished? Who can be a donor? What is the prevalence of kidney transplants? What is the availability of kidneys? What is the cost? Where can a kidney transplant be done locally?

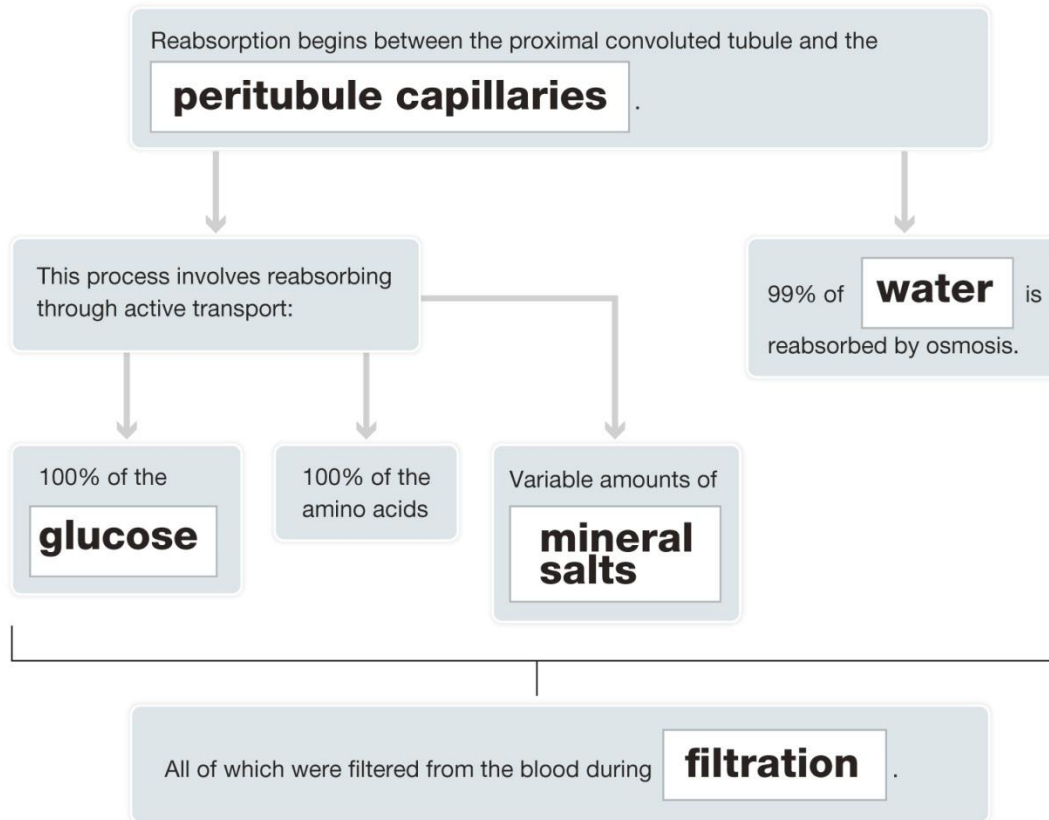
Once the class list of questions has been determined, divide the list among groups in the class to research and report back to the class as a whole.

ANSWER KEYS

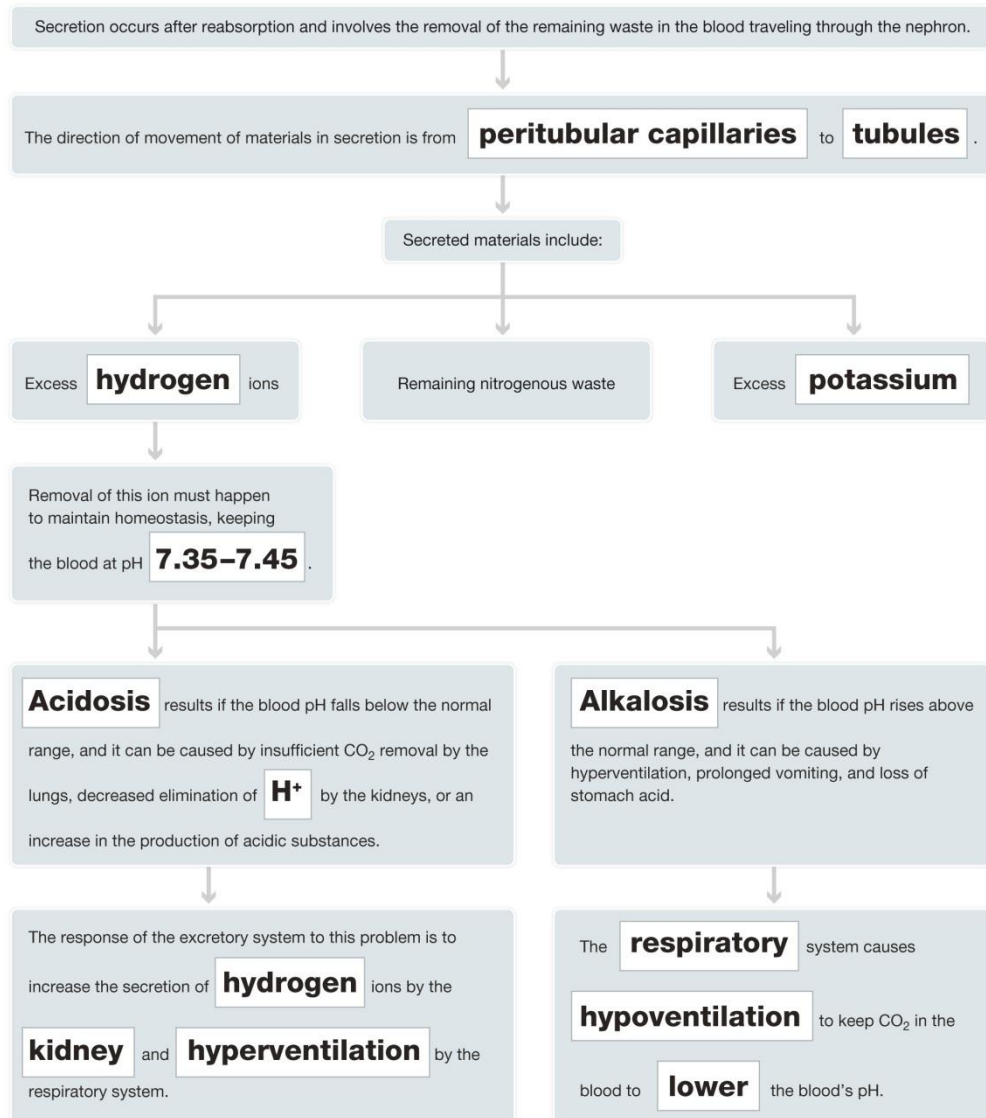
1. B
2. C
3. C
4. A
5. A
6. B
7. C
8. A
9. C
10. B
11. D
12. B
13. D
14. B
15. C
16. C
17. B
18. C

WORKBOOK CONCEPT MAPS:**Filtration**

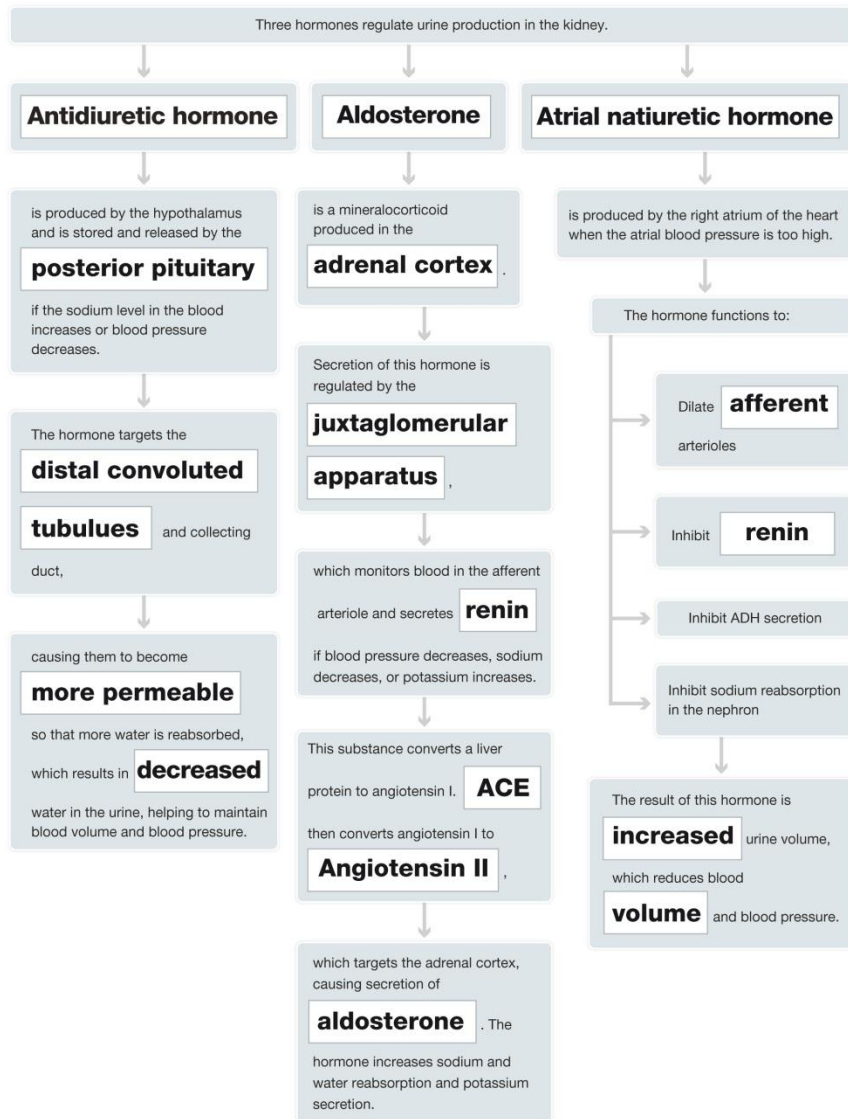
Reabsorption



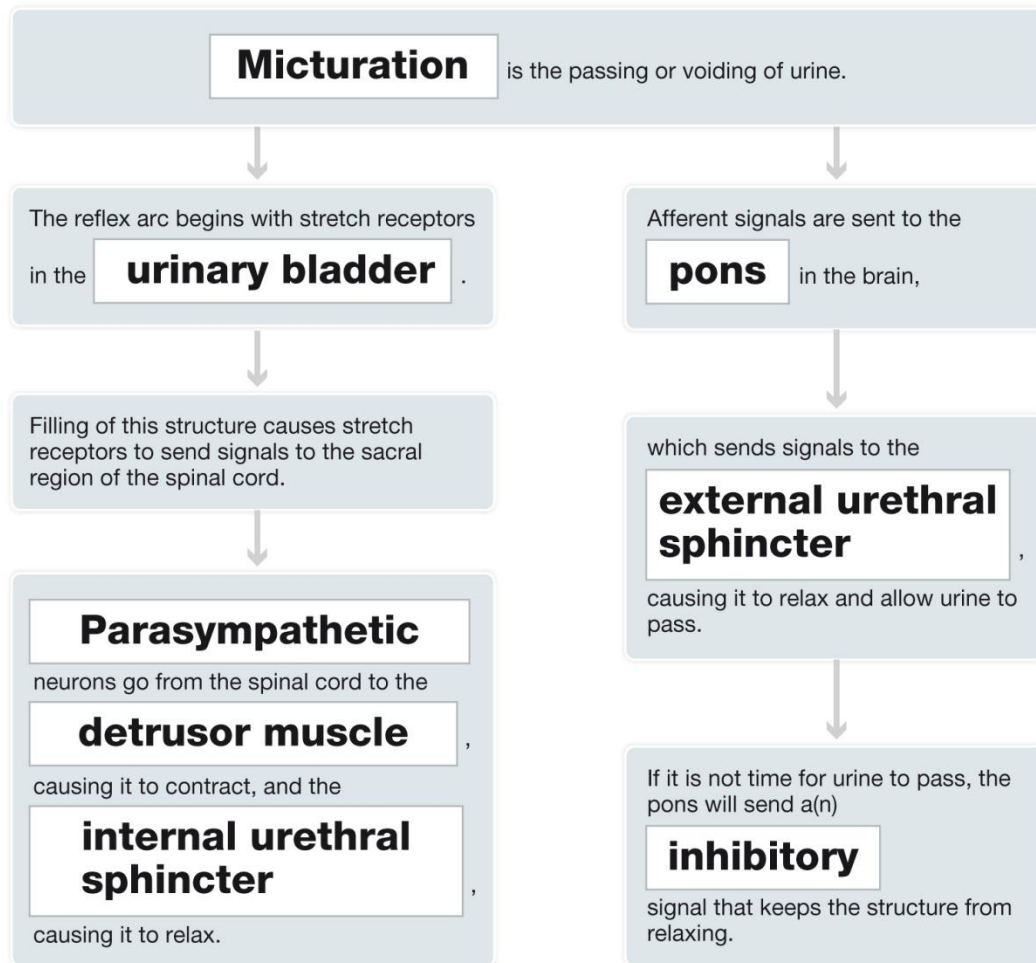
Secretion



Hormonal control



Micturition



Workbook Chapter Review Questions

Word Deconstruction:

In the textbook, you built words to fit a definition using the combining forms, prefixes, and suffixes. Here you are to break down the term into its parts (prefixes, roots, and suffixes) and give a definition. Prefixes and suffixes can be found inside the back cover of the textbook.

FOR EXAMPLE: Dermatitis: dermat/itis—inflammation of the skin

1. Glomerulonephritis: Glomerulo/nephr/itis, inflammation of the glomerulus and kidney
2. Ureteralgia: Ureter/algia, pain in the ureter
3. Renography: Reno/graphy, radiography of the kidney
4. Urethrostomy: Urethro/stomy, new opening in the urethra
5. Cystocele: Cysto/cele, hernia of the urinary bladder

Multiple Select:

Select the correct choices for each statement. The choices may be all correct, all incorrect, or any combination of correct and incorrect.

1. What do the kidneys do?

- a. The kidneys excrete wastes.*
- b. The kidneys monitor blood CO₂ levels.
- c. The kidneys are involved in vitamin K production.
- d. The kidneys produce EPO.*
- e. The kidneys help regulate blood volume, blood pressure, and blood concentration.*

2. How would you describe the kidneys?

- a. The kidneys are retroperitoneal.*
- b. The hilum is located laterally on each kidney.
- c. The renal cortex contains pyramids.
- d. The renal sinus contains the renal pelvis, renal artery, renal vein, and adipose tissue.*
- e. Minor calyces merge to form a major calyx.*

3. Where do the components of urine go as they flow through a nephron?

- a. The components travel from the nephron loop to the proximal convoluted tubule.
- b. The components travel from the distal convoluted tubule to the collecting duct.*
- c. The components go from the glomerular capsule to the nephron loop.
- d. The components leave a nephron through a collecting duct.*
- e. The components travel from the proximal convoluted tubule, to the nephron loop, and on to the distal convoluted tubule.*

4. Where does blood go as it flows through the kidney?

- a. Blood travels from the efferent arteriole to the glomerulus.
- b. Blood travels from the efferent arteriole to peritubular capillaries.*
- c. Blood travels from the afferent arteriole to the glomerulus.*
- d. Blood flows through two capillary beds.*

e. Blood travels from peritubular capillaries to venules.

5. Where is the water in the body?

a. Metabolic water is produced in most cells of the body.

b. Sixty-five percent of the water in the body is extracellular.

c. Water can be found in two fluid compartments.

d. Extracellular water includes lymph.

e. Water moves between compartments by filtration and active transport.

6. How are urine volume and concentration regulated?

a. Urine production is regulated by hormones from the anterior pituitary, the posterior pituitary, and the heart.

b. ADH causes sodium to be reabsorbed.

c. Aldosterone does not cause sodium to be reabsorbed.

d. ANH results in an increased volume of dilute urine.

e. ADH and aldosterone result in reduced urine volume.

7. How do diuretics work?

a. Alcohol inhibits aldosterone production.

b. Caffeine decreases blood flow to the kidney.

c. Diuretic drugs cause increased potassium reabsorption.

d. Diuretic drugs increase reabsorption of sodium.

e. Caffeine increases the glomerular filtration rate.

8. How would you describe the anatomy of the urinary system?

a. Ureters are retroperitoneal.

b. A ureter is much longer in a male than in a female.

c. The detrusor muscle forms the external urethral sphincter.

d. The detrusor muscle is an involuntary smooth muscle.

e. The renal pelvis leads into the urethra.

9. How does micturition work?

a. The medulla oblongata regulates micturition.

b. The pons regulates micturition.

c. Micturition is a reflex.

d. Micturition is a reflex and a voluntary activity.

e. Sympathetic neurons stimulate the passing of urine.

10. What can be expected of the excretory system as it ages?

a. Benign prostatic hyperplasia leads to incontinence in males.

b. Weakened pelvic floor muscles make the passing of urine difficult for women.

c. The glomerular filtration rate decreases with age.

d. The elderly are less responsive to ADH.

e. Drugs are less likely to be effective because they are cleared by the excretory system too quickly.

Matching:

Match the process of urine production to the description. Some choices may be used more than once.

- | | |
|--|-----------------|
| <u> a </u> 1. Happens in the renal corpuscle. | a. Filtration |
| <u> b, c </u> 2. Happens in the renal tubules. | b. Reabsorption |
| <u> b </u> 3. Moves water by osmosis. | c. Secretion |
| <u> c </u> 4. Moves materials from the peritubular capillaries to the tubules. | |
| <u> b </u> 5. Moves materials from the tubules to the peritubular capillaries. | |

Matching:

Match the structure to its description. Some choices may be used more than once. Some questions may have more than one answer.

- | | |
|---|-----------------------|
| <u> d </u> 6. Collects the products of filtration. | a. Afferent arteriole |
| <u> f </u> 7. Receives the products of secretion. | b. Efferent arteriole |
| <u> e </u> 8. Contains the glomerulus and the glomerular capsule. | c. Glomerulus |
| <u> b </u> 9. Takes blood away from the glomerulus. | d. Glomerular capsule |

___*a, f*___ 10. Contains part of the juxtaglomerular apparatus.

e. Renal corpuscle

f. Distal convoluted tubule

Completion:

Fill in the blanks to complete the following statements.

1. ___*Excretion*___ is the removal of metabolic wastes from the body.
2. ___*Creatinine*___ is a waste from the breakdown of creatine phosphate.
3. ___*Ammonia*___ is a highly toxic waste from the breakdown of amino acids.
4. ___*Urea*___ is a common waste from the ultimate breakdown of proteins.
5. ___*Uric acid*___ is a waste from the breakdown of nucleic acids.

Critical Thinking

1. Peter is an A&P student who is studying the excretory system. He decided to conduct an experiment on his own. He collected his morning urine and then drank 2 liters of water in the next hour and collected his urine again. What would you predict would be his next urine output and his urine concentration (based on a color comparison with his first urine sample)? What hormone is likely at work regulating his urine production? Explain.

Lighter and more dilute. ANH – the 2L of water consumed would be absorbed raising blood volume and blood pressure – the cells of the right atrium would secrete ANH in response to higher blood pressure.

2. In terms of function, why is a kidney transplant preferable to dialysis?

A transplanted kidney would function 24/7 to regulate blood volume and pressure – dialysis is usually done only 3 times a week.

3. Select one of the disorders covered in the chapter. Predict how that disorder would affect urinalysis results.

Answers will vary.

Case Study:

1. Hydronephrosis is the buildup of urine in the kidney.
2. Diagnostic tests used to diagnose this condition are CT, intravenous pyelography, ultrasound, blood tests and urine tests.
3. Birth defects that narrow the ureter are the likely cause of hydronephrosis.
4. Treatment involves removing the obstruction so the normal flow of urine from the kidney can be restored.